DOCUMENT RESUME

ED 288 492 IR 012 883

AUTHOR Hack, David
TITLE Telecommunications and Information-Systems Standardization--Is America Ready? CRS Report for Congress. Sci-Tech Alert. 87-458 SPR.
INSTITUTION Library of Congress, Washington, D.C. Congressional Research Service.
PUB DATE 21 May 87
NOTE 50p.
PUB TYPE Legal/Legislative/Regulatory Materials (090) -- Viewpoints (120) -- Reports - Descriptive (141)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Computers; Global Approach; Government Role; *Information Networks; International Cooperation; *Public Policy; *Standards; *Telecommunications

ABSTRACT

This report on telephone networks and computer networks in a global context focuses on the processes and organizations through which the standards that make this possible are set. The first of five major sections presents descriptions of the standardization process, including discussions of the various kinds of standards, advantages and disadvantages of standards, and both the U.S. and international organizations involved, i.e., the American National Standards Institute (ANSI), the U.S. National Bureau of Standards (NBS), the International Telecommunications Union (ITU), the International Organization for Standardization (ISO), and the GATT Standards Code. Applications of the Standardization process to telecommunications and computers are discussed in the second section, including the Open Systems Interconnection (OSI), the Corporation for Open Systems (COS), and the Integrated Services Digital (Telephone) Network (ISDN). The social impacts of telecommunication- and computer-standards applications in the U.S. are briefly discussed in the third section, and the fourth addresses public policy issues which may foreseeably arise from such standards or affect the standardization process. Related policy issues include international trade relations, antitrust, intellectual property, communications regulation, administration of the government's own information-systems establishment, and the funding of standards research. The standards, competitiveness, and trade issues involve the Department of State, the Department of Commerce, the Office of the U.S. Trade Representative, and the Federal Communications Commission. The concluding section presents sources of additional information, including selected publications and organizations. (RP)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

IR

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.
Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

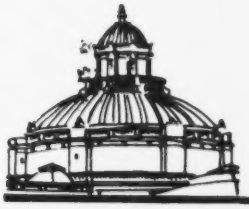
CRS REPORT FOR CONGRESS

Sci-Tech Alert

ED288492

TELECOMMUNICATIONS AND INFORMATION-SYSTEMS STANDARDIZATION --IS AMERICA READY?

David Hack
Analyst in Information Sciences and Technology
Science Policy Research Division



CRS

CONGRESSIONAL RESEARCH SERVICE
THE LIBRARY OF CONGRESS

May 21, 1987

IR013883

BEST COPY AVAILABLE

The Congressional Research Service works exclusively for the Congress, conducting research, analyzing legislation, and providing information at the request of committees, Members, and their staffs.

The Service makes such research available, without partisan bias, in many forms including studies, reports, compilations, digests, and background briefings. Upon request, CRS assists committees in analyzing legislative proposals and issues, and in assessing the possible effects of these proposals and their alternatives. The Service's senior specialists and subject analysts are also available for personal consultations in their respective fields of expertise.

ABSTRACT

Telecommunications and computer standards together are speeding the combination of telephone networks and computer networks on a global basis. This report concerns the processes and organizations through which standards for telecommunication and computer equipment are set. Examples are given of particular standards, their social or economic impacts, and the public policy issues which may foreseeably arise from such standards or, conversely, affect the standardization process. Related policy issues include international trade relations, antitrust, intellectual property, communications regulation, administration of the government's own information-systems establishment, and funding of standards research. The standards, competitiveness, and trade issues related to communications and computers involve the Department of State, the Department of Commerce, the Office of the U.S. Trade Representative, and the Federal Communications Commission. This CRS Report is one of a series of "Science and Technology Alerts," each of which describes a technology or process and its foreseeable impacts and issues.

CONTENTS

ABSTRACT iii

SUMMARY AND INTRODUCTION 1

DESCRIPTION OF THE STANDARDIZATION PROCESS 3
Informal and Formal Standards 3
Product Standards and Integrated-System Standards 5
Advantages and Disadvantages of Standards 6
U.S. Standardization Organizations and Process 8
The American National Standards Institute (ANSI) 8
The U.S. National Bureau of Standards (NBS) 9
International Standardization Organizations and Process 10
The International Telecommunications Union (ITU) 11
The International Organization for Standardization (ISO) 11
The GATT Standards Code 12

APPLICATIONS OF THE STANDARDIZATION PROCESS
TO TELECOMMUNICATIONS AND COMPUTERS 15
The Open Systems Interconnection (OSI) 15
The Corporation for Open Systems (COS) 18
The Integrated Services Digital (Telephone) Network--(ISDN) 19

U.S. SOCIAL IMPACTS
OF TELECOMMUNICATION- AND COMPUTER-STANDARDS APPLICATIONS 25

ISSUES AND PUBLIC POLICY 27
Standards, Domestic Competition, and International Trade 27
Multilateral Negotiations in U.S. Telecommunications and
Trade Policy 28
How Can The United States Effectively Represent
Its Position in ITU Negotiations (WATTC-88)? 28
How Can The United States Effectively Represent
Its Position in The Uruguay-Round GATT Negotiations? . . 29
Bilateral Telecommunications Trade Initiatives 30
In Congress: The "Telecommunications Trade Act" Proposal . 30
The FCC Examines Its Role 31
Selected U.S. Domestic Policy Areas that Affect
Telecommunications and Information-Systems Standards Policy 33
What Is The Relation of Antitrust Policy
to Standards Policy? 33
What Is The Relation of Intellectual-
Property Policy to Standards Policy? 34
How Much Should the Government Support
The Voluntary Standardization Process? 38
What Is The Government Doing
To Standardize Its Own Information Systems? 39

SOURCES OF ADDITIONAL INFORMATION 43
Selected CRS Issue Briefs and Reports 43
Statutes and OMB Circulars 44
Publications 45
Organizations 45

SUMMARY AND INTRODUCTION

This Alert concerns the organizations and processes by which telecommunications and computer standards are created and adopted and the applications, impacts, and public policy issues arising from and affecting those processes.

Increases in international trade, travel, and investment have vastly expanded international communication of information and the demand for the equipment and services on which international communications depend. Many private companies and Government agencies produce telecommunications and computer equipment and services. These products and services must be linked into world-wide networks. For linkage of different producers' equipment and services, the producers and network designers need world-wide standards for connections and compatibility; network managers need world-wide format standards for the messages and signals passed among networks. The increasing linkage of telecommunications and computer technologies in these networks has required standards developers from different nations, industries, and specialties to work closely together. As a consequence, views toward standards and international standards institutions by representatives of different specialties, industries, and nations are changing. Some companies and nations, who might otherwise prefer to be independent, fear that if they ignore ongoing international standardization efforts they will be foreclosed from entering future markets or left behind by the evolution of communications networks. Therefore, international standardization efforts for telecommunications and

computers now appear to have caused a politico-commercial environment favorable to increased standardization.

Telecommunications and computer standards together are speeding the combination of telephone networks and computer networks on a global basis. This enables firms to spin off portions of their design, engineering, production, marketing, sales, accounting, and legal activities to far-flung subsidiaries, affiliates, partners, and suppliers. More than ever, the United States will need to ensure that its manufacturing and service industries are competitive with offerings from abroad. The standards, competitiveness, and trade issues related to communications and computer standards involve the Department of State, the Department of Commerce, the Office of the U.S. Trade Representative, and the Federal Communications Commission. Related policy issues include multilateral and bilateral international trade relations; antitrust, intellectual-property, and communications-regulatory policy; administration of the Government's own information systems establishment; and funding of standards research.

DESCRIPTION OF THE STANDARDIZATION PROCESS

Standardization may be defined as the process of formulating and applying rules for an orderly approach to a specific activity, with the cooperation and for the benefit of all concerned. This may be contrasted with a view of standards as fixed rules. Although only about a century old as an organized activity, standardization has evolved into a complex process that can be considered both a discipline and an industry. Today's approach to standards emphasizes the process and incorporates a view of the future. Inappropriate standards may block innovation through excessively rigid rules. On the other hand, a proper standardization process can encourage economic growth by reducing the risk that product incompatibilities will result in industrial stagnation.

INFORMAL AND FORMAL STANDARDS

Computer and communications standards may come into existence in two ways, informal and formal:

Informal--Sometimes commercial events precede or overtake formal standards efforts. This may result from a very fast and successful research and development effort (or an effort undertaken in secrecy) by a company that opens a new market. The first vendor's solution, terminology, and product or service offering become well-known through the trade press, and may become models for later offerings by others. Sometimes commercial events so outflank the formal

standards process as to deter formal standardization efforts altogether. Standards that are thus formed informally may facilitate development of a market in the short run but may have unseen limitations or drawbacks which become manifest at a later time. If this occurs, the informal standard may then actually impede technical progress, or adversely affect commerce or trade, because no clear process exists for this standard's modification or evolution over time.

Formal--When technology and commercial practices advance at steady, predictable rates, standards can be developed concurrently with, or even in advance of, commercial application. Standards-development organizations can create the technical practices and rules that govern the new applications and new technology. In recent years, competing organizations have sometimes reconciled draft standards where parallel efforts have been underway. Some have even agreed to accept the standards efforts of others, further shortening the process of publishing a standard. When formal standardization efforts are undertaken early enough, and if those efforts are successful, the resulting standards may avoid the unseen limitations or drawbacks of informal, more hastily developed standards. In such a case, the range and lifetime of the standards' applicability may be increased.

Market endorsements for informal or de-facto standards can influence the formal standards process. If a formal-process organization ignores a strong existing informal standard, its formal standard may be disregarded altogether. If the formal-process organization publishes a standard that supports an existing product configuration, competitive vendors who market other configurations may be angered, but the new published standard is at least assured some following. Against the tendency to favor following a leading firm's specifications, some standards organizations support no vendor-sponsored

standards. U.S. organizations, particularly industry groups, usually take a pragmatic view but in some international standards bodies an inflexible independence may result in failure to reach any meaningful formal standard.

PRODUCT STANDARDS AND INTEGRATED-SYSTEM STANDARDS

Both informal and formal standards for computers and communications may be divided into product and integrated-system standards. Product standards deal with characteristics of individual computer and communications commercial products, for example: 8-inch, 5 1/4 -inch, and 3 1/2 -inch floppy disks or the 12-button keypad on a tone-dialing telephone. Integrated-system standards are born of: (1) the need for standards in newly developed high technologies and (2) the tendency of technologies such as computers and communications (formerly perceived as separate) to converge. An example of an integrated system standard is the standard embodied in the U.S. telephone network. That network is based on a system of individual product standards and signaling protocols which enable direct-distance dialing from any 10-digit subscriber telephone number to any other, throughout the United States, provided that the essential elements of the system standard are fully implemented in the local telephone exchanges, all the way up to the subscriber desksets. Other examples of integrated-system standards include the Open Systems Interconection (OSI) and the Integrated Systems Digital Network (ISDN) standards, both of which will be described later in this report.

The integrated-systems approach helps establish a direction for standards development consistent with the overall objectives of the communications and computer industries and allows for multiple development efforts to be integrated into a cohesive structure. The total-system outlook results in

better standards (1) by helping ensure that a standard for one part of a system does not disallow something that is important in another part of the system and (2) by helping ensure that the design choices made in today's products, and the precedents they establish, do not create unnecessary restrictions on design options for the future. In this way standards are used to preserve and enhance opportunities for innovation.

ADVANTAGES AND DISADVANTAGES OF STANDARDS

In order for computer and communications standardization to be in the public interest, the resulting standards must meet some social need or requirement. For example, by design or otherwise, computer and communications engineering standards may:

- Directly increase the manufacturing efficiency of computer- and communications-equipment manufacturing industries through larger-scale, lower-cost production of uniform, interchangeable parts, assemblies, and systems;
- Indirectly increase all manufacturing efficiency through advances in process technology;
- Foster innovation by allowing new products and services to be based on known standards, assuring compatibility with capital equipment and human skills already in place;
- Disseminate information and stimulate transfer of computer and communications technology (standards constitute a vast store of expert technological information that may serve as a foundation for new producers);
- Expand international trade by facilitating exchange of computer and communications products among countries and conserve resources through efficiencies of "comparative advantage;"
- Foster competition by enabling smaller firms and poorer nations to market computer and communications products which are readily accepted in national and international trade (without the cost of heavy advertising and other marketing expenses to establish product identity and reputation);

- Reduce the need for complicated and expensive communications "bridge" or "gateway" equipment to serve as translators between otherwise incompatible equipment or systems; and

- Assure the safety and reliability of computer and communications products.

In addition to the above benefits, communications and computer standards may also increase the opportunity for worldwide exchange of information--through voice, text, numerical data, graphics, pictures, and motion video. On the other hand, arguments may be marshalled against the development and promotion of standards. These include the following.

- Standards may limit the choices available in product or service categories;

- Not everyone views even "properly designed" standards as beneficial. Manufacturers who wish to acquire and maintain a "captive" customer base by selling systems based on their own proprietary standards may see any industry-wide standards as limiting their market advantage; and

- Standards which are improperly designed but widely implemented may inhibit innovation and other (perhaps superior) approaches.

The last view may be of special concern in the telecommunications and computer fields today because the trend now is to develop standards on the international level prior to widespread implementation of a new technology and prior to experimentation with provisional standards at the national level. In addition to the above objections, the benefits listed as satisfying some social need or requirement also have a negative side which will be discussed under ISSUES AND PUBLIC POLICY below.

U.S. STANDARDIZATION ORGANIZATIONS AND PROCESS

The American National Standards Institute (ANSI)

In the United States today, most commercial standards are "voluntary" standards. This means that they are developed largely by committees of interested parties and their use is not mandatory. Exceptions are those standards relating to safety, health, and the environment which are established by statute or regulation. Private standards-setting organizations in the United States are coordinated by the American National Standards Institute (ANSI). ANSI is a nonprofit, nongovernmental organization incorporated under the laws of New York State. Although the U.S. Department of State is the Government agency principally responsible for carrying out the President's constitutional duty of representing the United States before foreign governments, the Department has deferred entirely to ANSI to represent the United States in matters before the International Organization for Standardization (ISO). (U.S. representation to the International Telecommunications Union is more complex, and is described under International Standardization Organizations.)

ANSI standards originate in the work of its 300 Standards Committees or that of associated professional and trade organizations. At the outset of creating a new standard, ANSI either recognizes a pre-existing professional or industrial organization as the official drafter of a proposed standard or organizes such a group if none exists. According to the ANSI 1976 Progress Report, ANSI's role in the approval process for a draft standard is to see that: all substantially concerned parties have had an opportunity to express their views and these views have been carefully considered; there is evidence

of use or potential use of the standard; any recognized significant conflict with another American National Standard has been resolved; consideration has been given to the existence of other standards having national or international acceptance in the given field; the standard is in accord with the public interest; the standard contains no unfair provisions; and there is evidence of (a) the standard's technical quality and (b) committee compliance with the Institute's procedures. The Institute's procedures include publication and circulation of each proposed standard, receipt of reviews and comments during a comment period of published duration, and action on the comments received after consideration of the comments. Throughout the development of a new standard, there is allowance for "due-process" in ANSI's deliberations, including rights to appeal actions at several levels of review.

U.S. computer and communications participant organizations under ANSI coordination include the following: (a) The Electronic Industries Association (EIA), founded 1924, a trade association representing many U.S. electronics manufacturers; (b) The Institute of Electrical and Electronics Engineers (IEEE), a professional association established 1884, which prepares standards for the data communications industry; and (c) The National Bureau of Standards (NBS), established in the early 1900s, a bureau of the U.S. Department of Commerce.

The U.S. National Bureau of Standards (NBS)

The National Bureau of Standards (NBS) does not set U.S. domestic computer standards but instead participates in the U.S. private, voluntary standards setting organizations and contributes to such organizations through NBS programs of research-and-development, information dissemination, and symposium

sponsorship. NBS' authority in its voluntary-standards-organization participation derives not from statutory power, but from the technical expertise of its personnel, the capability of its laboratories, and its role as representative of the large community of Federal Government computer users. Its original (and still-important) role, however, is to develop and recommend (to the Secretary of Commerce) standards for U.S. Government internal use in the purchase of equipment and supplies. The Brooks Act (1965; P. L. 89-306, 79 Stat. 1127) amended the Federal Property and Administrative Services Act of 1949 (63 Stat. 377) and gave authority to the Department of Commerce for developing Federal data processing standards. Computer standards resulting from this role are called Federal Information Processing Standards (FIPS). The NBS' activities in computers and communications are carried out by its Institute for Computer Sciences and Technology (ICST) and date from the 1960s. The ICST was formed at the NBS in 1972 under authority of the Brooks Act.

INTERNATIONAL STANDARDIZATION ORGANIZATIONS AND PROCESS

Although standards are developed in many parts of the world by private corporations and associations or national government agencies, all types of communications and computer standards are now increasingly developed cooperatively among nations through international organizations. The major international standards organizations concerned with computers and communications include the International Telecommunications Union (ITU) and the International Organization for Standardization (ISO).

The International Telecommunications Union (ITU)

When nations realized the need for standards to establish international telegraph services, they created by treaty the Union Telegraphique in 1865. In 1932, the Union Telegraphique merged with the International Radiotelegraph Convention to become the International Telecommunications Union (ITU). The ITU became a specialized agency of the United Nations in 1947. Today the ITU, headquartered in Switzerland, has over 160 member-nations. The ITU has two major committees: The International Telegraph and Telephone Consultative Committee (CCITT) and The International Radio Consultative Committee (CCIR). The CCITT is the international organization that is most involved in telecommunications standards.

The U.S. Department of State has chosen to discharge its responsibility for U.S. representation to the CCITT in two ways. The first is through a "public advisory committee," the U.S. Organization For The CCITT, whose charter is maintained and approved by the State Department (similarly, there is a U.S. Organization For The CCIR). The second way is through leading delegations to many of the CCITT (and CCIR) meetings, or designating a U.S. company as a Recognized Private Operating Agency (e.g., AT&T) or Scientific and Industrial Organization (e.g., IBM). These designations allow companies and organizations to participate in their own name (rather than in the name of the United States) in CCITT (or CCIR) activities.

The International Organization for Standardization (ISO)

The International Organization for Standardization (ISO) is a non-treaty organization founded in 1947, also headquartered in Switzerland. It has 90 member-nations. The ISO, through its Technical Committee 97, Computers and

Information Processing, is the international organization most involved in computer standards. Each nation designates its ISO member-representative. The United States Government has chosen to assign its member-representative role to the private, non-profit American National Standards Institute (ANSI). Participating Members of the ISO's TC 97 are: Australia, Brazil, Canada, Czechoslovakia, Finland, France, West Germany, Hungary, Italy, Japan, the Netherlands, Poland, Rumania, Spain, Sweden, Switzerland, the United Kingdom, the United States, and the Soviet Union. There are, in addition, 17 national Observing Members of TC 97.

Many international standards participants and organizations share a view of standardization as a public good whose value is increased by maximum inclusion of interested parties. This view is especially typical of participants whose outlook has been influenced by the voluntary standards system of the United States and the U.S. social values which underlie that system: that "due process" and the building of consensus from a marketplace of ideas can have socially beneficial results. Some participants have a different view of the standards process as primarily a contest, where there are advantages to be won or lost for company or nation. Awareness of these differing "world-views" (win-win or win-lose) is needed by standards process participants.

The GATT Standards Code

Another piece of the international standards regime is the Agreement on Technical Barriers to Trade, commonly called "The GATT Standards Code." Initiated by the United States Government at the request of U.S. private-sector interests, the Agreement was reached in 1979 (after many years of

negotiations) during the Tokyo-Round of the General Agreement on Tariffs and Trade (GATT). The GATT Standards Code entered into force in 1980. It is an agreement to refrain from using national standards to frustrate trade in products. It is designed to eliminate use of standards-related activities to erect or maintain barriers to trade and to encourage the general use of international standards. It established international principles by which at least 38 nations agreed to conduct their respective domestic standards-related activities--including voluntary standards, government regulations, and requirements for testing, packaging, and labeling. The Standards Code applies to all agricultural and industrial products in commerce, including computer and communications products; it does not, however, apply to government purchasing specifications, standards internal to private companies, or services. Government purchasing specifications are addressed in the separate Agreement on Government Procurement, under the GATT. Unfortunately for U.S. interests, all the major signatories with PTTs (postal, telegraph and telephone ministries) excluded those ministries from the agreement, and the PTTs still buy their telecommunications equipment primarily from domestic producers.

In the United States, the Gatt Standards Code is given effect by the Trade Agreements Act of 1979. The Act designates four Government agencies as overseers: Commerce, State, Agriculture, and the Office of the U.S. Trade Representative. The Code does not create specific product standards, testing methods, or certification systems. Rather, it establishes, for the first time, international rules among national governments regarding their respective national standards, and their associated testing and certification systems. Generally, the United States standards-setting process follows these basic rules, and the United States is recognized as having an open standards-setting system accessible to both foreign and domestic parties. Before the Code, many

other countries' standards-related activities had been generally closed to foreign participation.

The Code addresses governmental and non-governmental standards. However, only central governments are directly bound by the Code. Further, the Code requires only that signatories "take such reasonable measures as may be available to them" to ensure compliance of State and local governments, private sector organizations, and regional authorities. The Code specifically addresses the subjects of testing and information availability and creates both a dispute settlement process and an overseeing Committee on Technical Barriers to Trade. The committee has the power to investigate alleged transgressions and recommend action including that the benefits of the Standards Code be withdrawn for specific violations. The United States regards its own enforcement mechanisms as adequate to ensure domestic compliance; however (at the second three-year review of the Code in October 1985) the United States proposed amending the Code to reinforce the obligation of all signatories to ensure that regional bodies comply. The status of U.S. efforts to amend the GATT is discussed under Multilateral Negotiations in U.S. Telecommunications and Trade Policy, below.

APPLICATIONS OF THE STANDARDIZATION PROCESS TO TELECOMMUNICATIONS AND COMPUTERS

The two largest efforts in applying the standardization process to computers and communications have become known as the Open Systems Interconnection (OSI) "reference model" and the Integrated Services Digital Network (ISDN) model.

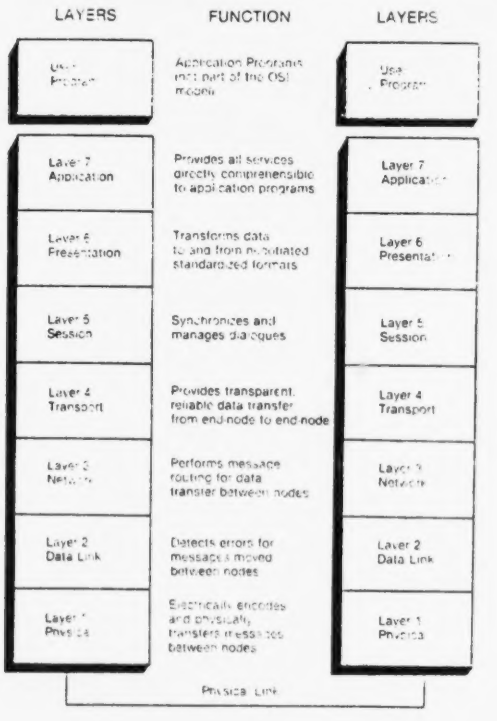
THE OPEN SYSTEMS INTERCONNECTION (OSI)

The Open Systems Interconnection (OSI) reference model specifies an "architecture" to be used for communication among computers. It has been developed and sponsored by the International Standards Organization (ISO) and the International Telegraph and Telephone Consultative Committee (CCITT) of the ITU. The OSI reference model does not specify any electronic circuits or protocols, but defines and categorizes the range of function-types that must be performed in a computer network for effective communication (figure 1).

The OSI reference model is an international standard. The model, and systems fashioned after it, are comprised of seven sequential layers of technical communications services which must be performed to get computer data from one computer application program out of its host machine, into a communications network, and then back into another computer application program hosted by another machine. The OSI model describes an architecture that enables computers and communications equipment from different manufacturers,

designed for different applications, to exchange information whether a mile or a world apart. The seven layer-definitions are written to be implemented in a mutually exclusive way, so that equipment changes internal to any one layer require no changes to any other layer. This means that the signals passed at any interface between layers are the same, regardless of who manufactures the equipment on either side of the interface. The names and definitions of the seven layers are given in the schematic diagram of figure 1.

FIGURE 1. The OSI Reference Model


LAYERS
FUNCTION
LAYERS
Application Programs not part of the OSI model
Provides all services directly comprehensible to application programs
Layer 7 Application
Transforms data to and from negotiated standardized formats
Layer 6 Presentation
Synchronizes and manages dialogues
Layer 5 Session
Provides transparent, reliable data transfer from end-node to end-node
Layer 4 Transport
Performs message routing for data transfer between nodes
Layer 3 Network
Detects errors for messages moved between nodes
Layer 2 Data Link
Electrically encodes and physically transfers messages between nodes
Layer 1 Physical
Physical Link

Source: NBS.

The OSI reference model is supported by the European Computer Manufacturers Association (ECMA), the Institute of Electrical and Electronics

Engineers (IEEE), the American National Standards Institute (ANSI), and the U.S. National Bureau of Standards (NBS), among others. In Europe, especially, the OSI effort is seen as an alternative to a proprietary network model known as Systems Network Architecture (SNA), established by the IBM company. Because of IBM's dominant position in the mainframe computer market, SNA has become an informal standard for networking "mainframe" computer systems. European manufacturers especially (and their national governments) prefer to avoid further consolidation of network-standards control by IBM. An innovative SNA product based on protocols not announced by IBM could be made obsolete if IBM later announced and marketed contradictory protocols. However, broadly adopted industry standards can become self-enforcing on industry participants, even major ones. IBM has become a public supporter of international standards based on the OSI model. The American Telephone and Telegraph company (AT&T) introduced in 1983 its own network architecture, Information Systems Architecture, which is closely modeled after the OSI reference model.

Large computer-using corporations have supported the OSI model also. In 1980, General Motors began an initiative to connect the "islands of automation" in its manufacturing plants. GM chose to fashion its Manufacturing Automation Protocol (MAP) in the OSI framework. Boeing then followed GM's example by initiating a Technical Office Protocol (TOP) to connect islands of office automation. The MAP and TOP implementations differ from one another only at OSI levels 1 and 7. Level 1 is the Physical level: the material medium required to span the distance between communicating machines, carry the electronic (or other) signals, and withstand the physical environment of the factory or office location; level 7 is the Application level, which interfaces directly with the types of applications of interest in the factory or office. MAP and TOP are often described as among the first realizations in hardware of

the OSI's promise of interoperability. In 1984, 14 organizations successfully demonstrated a limited group of OSI computer network standards at the National Computer Conference. In 1985, the Computer and Automated Systems Section of the Society of Manufacturing Engineers (CASS/SME) sponsored AUTOFACT '85, a conference and exposition on the automated, integrated factory. There, some 21 computer and communications companies demonstrated more extensive factory and office applications of OSI, implemented as MAP 2.1. GM and Boeing have stated that their computer and communications vendors must meet the MAP or TOP standards if they want the MAP/TOP sponsors' business.

Also in 1986, 25 industry and Government organizations including the NBS agreed to jointly develop OSINET, an experimental computer network for OSI standards. This venture is coordinated by the NBS, in cooperation with the Corporation for Open Systems (see below) and the MAP/TOP Users Group, and is expected to help speed the development and use of OSI standards in industry and government. The OSINET will be used by the cooperating organizations to build and test computer-communications systems comprised of multi-manufacturer products, to develop test methods and systems, and to carry out OSI-related research. The initial connections for the network were made in August, 1986.

The Corporation for Open Systems (COS)

Early in 1986, several dozen North American computer and communications equipment companies joined to form the Corporation for Open Systems (COS), headquartered in McLean, Virginia. This consortium promotes commercialization of the Open Systems Interconnection model and the Integrated Services Digital Network model described below. The COS plans to adopt initially a minimal subset of international networking specifications based on OSI, and to promote

equipment compatibility by supporting rigorous equipment testing and certification. Its member list of over 50 companies includes nearly every large communications or computer equipment vendor in North America: for example, IBM, Digital Equipment, AT&T, and Northern Telecom, plus large equipment-users such as General Motors, Boeing, and Eastman Kodak. The collective stature of its member companies assures the consortium considerable influence, if the collaboration proves productive. Two factors tend to assure that the collaboration will be seriously approached: (a) representation to COS must be at top management levels for each member company and (b) the annual membership fee for each company ranges from $25,000 to $200,000.

Although the COS has begun a drive to enlist Japanese and European companies as members, an official of the Japanese Ministry of International Trade and Industry (MITI) said that COS should meet with its Japanese counterpart, the Promoting Conference for Open Systems Interconnection (POSI), and its European counterpart, the Standards Promotion and Application Group (SPAG). MITI wants to assure Japan an equal voice with North America and Europe; COS President Lincoln D. Faurer said that COS will share information with the Japanese and European groups, but if the Japanese want a vote in COS proceedings, their companies will have to become members.

THE INTEGRATED SERVICES DIGITAL (TELEPHONE) NETWORK--(ISDN)

Communications analyst Anthony Rutkowski, in a 1985 book on ISDN, described it broadly as follows:

> Conceptually, the term ISDN represents a technical and operational model for a universal, intelligent, and modular [telecommunications] information system that includes as a prominent feature the transport of information on a global scale. In its ultimate form it would be even more ubiquitous than our electrical power system. It would provide anyone, anywhere, with any kind of electronic information

> service desired. What we now visualize as separate telecommunication and [computer] information systems would be completely integrated.

A more modest estimate of The Integrated Services Digital Network (ISDN) model is that it does for telephone networks what the OSI model does for computer networks. The ISDN model has been developed and promoted by the International Telegraph and Telephone Consultative Committee (CCITT) of the International Telecommunications Union. The ISDN model has much in common with the Open System Interconnection model, including virtual congruence with the first three of the OSI's seven layers.

Under the OSI and ISDN models for standards specification, computer networks and telephone networks are rapidly converging. There are two basic ways in which information of any type can be transmitted over communications networks: with analog or digital signals (figure 2). Analog transmission means that the transmitted signal varies continuously within a defined range. Digital transmission (binary digital transmission, actually) means that a stream of on/off pulses is sent; the "on" and the "off" signals are each essentially constant at one of two values.

FIGURE 2. Illustration of Analog and Digital Signals

Source: The Structure of Telecommunications Networks, p. 113.

Analog is the conventional basis for telephone signals (and for television and radio programming transmitted through the telephone network) because human speech and hearing are analog. Also, analog electronics developed more rapidly

than digital electronics as early telephone systems were being built (even though the first telegraph system, predating telephones, was based on electrical pulses in Morse code and was thus digital).

In the 1980s, analog telephone signals are being rapidly replaced by the digital electronic signals now common to computers. One favorable consequence of having a digital telephone network is that computer data can be sent over the telephone network in its native digital form, so that modulator-demodulators (modems) are not needed to convert from digital to analog form and back again, as at present. (Of course, another consequence of digital networks is that speech cannot be sent over the network in its native analog form but it must be processed at entry to, and exit from, the network.)

All categories of information--data, voice, video, graphics--once they are expressed in digital form, can travel over a common network, an Integrated-Services Digital Network (ISDN). Currently, all forms of information can be converted to analog form for transmission over a common analog network, but digital networks offer great advantages of technical flexibility in using the network for a wide variety of differing needs. In addition, some believe (and others hope) that digital networks will someday be able to use their technical flexibility to achieve gains in economic efficiency, while preserving or increasing social equity: sharing fairly the network costs among the largest and the smallest network users.

ISDN standards may integrate communication services like voice, data, video, facsimile and others on a worldwide network. Exchange of information worldwide through computer and communications machinery and their connective media may require as little translation of the machine codes as currently required for humans speaking face to face in a common human language. If fully realized, the ISDN concept would provide, on the public telephone network, many

of the communications capabilities now available only on all-digital private networks. As currently planned, having ISDN service to the telephone plug would offer the telephone three channels, including at least one for data, instead of the one voice channel currently.

From a quiet beginning in 1968, the ISDN work has become a major activity of the CCITT. The ideas that led to the ISDN general network model were developed in the CCITT's Special Study Group D (1968-1976) and Study Group XVIII (1976-1984). In 1980, the CCITT's 7th Plenary Assembly in Geneva assigned to Study Group XVIII the responsibility of coordinating the ISDN-related studies in nine of the other fourteen CCITT Study Groups. In the same year, the CCITT declared ISDN to be the major concern of the 1981-1984 study period. The Eighth Plenary Assembly in October, 1984, took several actions affecting future ISDN work. (a) The former Study Group XVIII (ISDN) Chairman, Theodore Irmer, was elected Director of the CCITT. (b) The CCITT was restructured to give several of its study groups a part of future ISDN work and the dominant function of the CCITT became the study of ISDN matters. The CCITT expects its ISDN recommendations to be sufficiently established by the late 1980s to make digital subscriber services common in the 1990s.

The trend to focus the CCITT efforts around ISDN may be furthered in the future. The Eighth CCITT Plenary Assembly established two more ISDN-oriented activities. The first is a Special Study Group S to examine possible major restructuring of the CCITT. The second is a CCITT "Preparatory Committee," in anticipation of the 1988 World Administrative Telegraph and Telephone Conference (WATTC-88). According to Anthony Rutkowski (Integrated Services Digital Networks, 1985, p. 257), WATTC-88 could add a new dimension to ISDN developments, because of its potential to put ISDN concepts into a treaty

instrument governing telecommunications arrangements among the ITU's member nations.

The ISDN concept evolved largely outside the United States. In some respects, it is tied to traditional PTT (postal, telegraph and telephone ministry) public service thinking about telecommunications: there should be one highly capable public network providing equal service to everyone. Proponents of extensive capability requirements (at OSI levels four through seven) for public networks seem to favor similar requirements of private networks, to make all networks technically similar. They explain the need for such requirements on private networks in terms of ensuring a "level playing-field" for the PTTs vis-a-vis the private networks. Those who favor more basic network requirements tend to emphasize the advantages of allowing open-ended innovation at OSI levels four through seven, overlaid on a universally inter-operable network design at OSI levels one to three. A resolution of the more extensive and the more basic approaches to international network design standards requires study, planning, and negotiation. The implications for U.S. policy, of CCITT plans for a ISDN treaty instrument to be developed through the WATTC-88 conference, are discussed under Issues and Public Policy.

U.S. SOCIAL IMPACTS OF TELECOMMUNICATION- AND COMPUTER-STANDARDS APPLICATIONS

Together, the OSI and ISDN standards would combine computer networks with telephone networks on a global basis. Telecommunication of textual and numerical information is already making financial services a worldwide rather than national industry and OSI- and ISDN-based networks promise to accelerate that trend. Many international legal services already can be provided at a distance through telecommunications. With advances in digital representation of pictorial and graphic information, medical, engineering, and design services are becoming deliverable via telecommunications across national and hemispheric boundaries. Various implementations of videotelephone concepts may one day, through international ISDN networks, provide even greater immediacy to intercontinental collaboration.

Some analysts have suggested that the United States may compensate for a loss of trade position in consumer and high-technology manufacturing through expansion of its services sector. However, the U.S. economy may also see stronger marketing efforts for (and increased sales of) services from abroad. Others say that the deregulated U.S. domestic telecommunications industry may be particularly well-situated to compete with other more heavily regulated nations as a host-nation for development of new communications-based service providers (medical, legal, financial, design and engineering). Yet even this can cut another way: we can expect to see still more foreign manufacturing of products designed and engineered in the United States--to U.S. tastes and

standards for U.S. consumption. Such products increasingly can be custom-manufactured (with rapid turnaround) from tele-communicated design and engineering specifications. More than ever, the United States will need to ensure that its own industries, manufacturing industries specifically included, are competitive with offerings from abroad.

ISSUES AND PUBLIC POLICY

STANDARDS, DOMESTIC COMPETITION, AND INTERNATIONAL TRADE

The U.S. approach to domestic telecommunications and information-systems regulation differs from that of most other nations. The U.S. domestic telecommunications policy trend over two decades has been to separate the provision of telephone terminal equipment from telecommunications services and to separate and deregulate the provision of so-called enhanced services (sometimes called value-added services or information-systems services). The U.S. policy trend is to structure the services categories and their regulatory framework so that vendor competition can emerge in categories for which competition is feasible.

This U.S. approach is almost unique in the world. While there are definite signs of increased competition in other countries, no country allows in its telecommunications sector the degree of foreign ownership and competition found in the United States. With few exceptions (e.g., Canada and the United Kingdom), almost all other countries provide telecommunications services (and equipment in some cases) through a postal, telegraph and telephone (PTT) ministry--a government-owned or government-controlled agency. Japan is the most recent nation to privatize and open up its telecommunications services to foreign participation. On April 1, 1985, the Telecommunications Business Law became effective in Japan. This law caused the Japanese telecommunications monopoly--Nippon Telephone and Telegraph (NTT)--to be

restructured between 1980 and 1985 into a one-third-privately-owned corporation. Reports from U.S. business say, however, that the Japanese market for telecommunications equipment remains essentially closed.

The United States has been a firm supporter of freer international trade generally and in specific regard to telecommunications and information-systems services and products. The differences between the United States and other nations, in domestic telecommunications policy and in approaches to international trade, raise questions of international policy for standardization of telecommunications products and services worldwide. The U.S. negotiating posture is taken up in the following arenas:

Multilateral Negotiations in U.S. Telecommunications and Trade Policy

Several agencies of the U.S. Government are involved in multilateral negotiations affecting (1) international telecommunications service and (2) international trade treatment of telecommunications products. The principal agencies involved are the Department of State, the Department of Commerce, the Office of the U.S. Trade Representative, and the Federal Communications Commission (FCC).

How Can The United States Effectively Represent Its Position in ITU Negotiations (WATTC-88)?

The 1988 World Administrative Telegraph and Telephone Conference (WATTC-88) under the International Telecommunications Union's Telegraph and Telephone Consultative Committee (ITU/CCITT) looms large for U.S. interests; the treaty instrument to be forged at that conference is expected to establish effective definitions governing international telecommunications service. For example:

(1) What services (and products?) shall constitute "telecommunications" and be subject to international agreements for telecommunications regulation?

(2) What impact would the scope of ITU/CCITT telecommunications services regulation have on other negotiations, such as the GATT Uruguay Round and bilateral agreements?

In U.S. regulatory terms, the WATTC-88 treaty instrument may define the boundary between "basic service" (telephone service) and "enhanced services" (computer and information-systems services delivered over telecommunications media). The United States wants flexibility in service provision, which might be excluded by specific definitions. Service boundary definitions reached under auspices of the ITU may also have an impact on the U.S.-sponsored objective, in the GATT Uruguay Round described below, of extending the scope of the GATT to trade in services. Thus, preparation for WATTC-88 is important for U.S. objectives in both international telecommunications regulation and international trade agreements. A thorough preparation will include planning a strategy for achieving U.S. objectives.

How Can The United States Effectively Represent Its Position in The Uruguay-Round GATT Negotiations?

The General Agreement on Tariffs and Trade (GATT) is a multilateral trade agreement, established in 1947, to promote freer trade among member countries. The General Agreement provides a forum for negotiating trade issues and a framework of principles to guide the conduct of trade. Central features of the GATT framework are: (1) nondiscrimination in trade; (2) reliance on tariffs alone (not on other means such as domestic technical standards) when a nation decides to take measures to protect its domestic producers; (3) adherence to pre-negotiated fixed, maximum tariff rates; and (4) settlement of disputes through consultation and conciliation. The 92 member-nations of the GATT

account for over 80 percent of world trade. In September 1986, representatives of 74 nations met in Punta del Este, Uraguay, to set an agenda for a new round of multilateral trade negotiations under the GATT. At the Uruguay conference, the United States proposed--and the representatives accepted for negotiation over a four-year period--the following objectives:

(1) to establish rules for trade in services and for trade related to foreign investment similar to those for trade in goods;

(2) to develop better international protection of intellectual property rights; and

(3) to establish dispute settlement and enforcement procedures in the GATT.

For further information on GATT negotiations, see CRS Issue Brief 86147, "Trade Negotiations: The Uruguay Round."

Bilateral Telecommunications Trade Initiatives

In Congress: The "Telecommunications Trade Act" Proposals

In the 100th Congress, S. 596 and title II of H.R. 3 are both titled the "Telecommunications Trade Act." Sponsors of H.R. 3, title II, find that: (1) rapid growth in the world market for telecommunications products and services will continue for several decades; (2) the United States can improve prospects for growth of U.S. telecommunications product and service exports, growth of export-related employment, and continued U.S. technological leadership; (3) most foreign markets for telecommunications products, services, and investment include extensive government intervention, restrictive import practices, and discriminatory procurement practices which adversely affect U.S. telecommunications exports and investment; (4) unfair and discriminatory trade practices in foreign countries have resulted in and threaten loss of jobs in

the U.S. telecommunications industry; (5) the open nature of the U.S. telecommunications market, including recent liberalization and restructuring of that market, has resulted in a growing imbalance of telecommunications trade opportunities; and (6) unless this imbalance is corrected, the United States should avoid granting continued open access of other nations' telecommunications industries to the U.S. market.

H.R. 3, title II, would establish several "negotiating objectives." Among these are: (a) gaining assurances that U.S. products made for export to other nations will not be denied "registration" for import by those nations so long as the products are certified by their manufacturer to meet the standards established by the importing nation for preventing harm to that nation's telecommunications network; and (b) open participation in the standards-setting processes used by importing countries for telecommunications products. H.R. 3 was debated by the House April 28-30, 1987, and passed 290-137.

The Senate Finance Committee incorporated the Telecommunications Trade Act bill (S. 596) into the Omnibus Trade Act bill (S. 490) and ordered S. 490 reported to the Senate on May 7, 1987. Though the House and Senate versions of the Telecommunications Trade Act are similar on some points, each has many features, and opinions differ on which is "softer" or "tougher."

The FCC Examines Its Role

The Federal Communications Commission is studying the authority it may have to affect telecommunications trade. The Commission, on December 23, 1986 (Docket 86-494/Report DC-721), adopted a Notice of Inquiry and Proposed Rulemaking to examine the interrelationship of its regulatory policies with the telecommunications policies of foreign governments. The Commission indicated

that it would consider, as the agency directed by Congress to set domestic regulatory telecommunications policy, whether it should address the effect of policies of foreign nations on U.S. telecommunications firms and U.S. consumers.

The Commission asked that parties comment on the nature and extent of entry barriers and discriminatory treatment in international telecommunications and the measures the FCC could take to promote open entry, nondiscrimination, and technological innovation. The Commission emphasized that it launched this proceeding in search of common ground with other countries on these issues. It acknowledged, however, that the U.S. Government is increasingly concerned that U.S. telecommunications service providers and equipment manufacturers are not permitted to operate, or are not provided with a fair opportunity to compete, in a number of foreign markets. The Commission asked parties to comment on whether it can take and should consider taking actions that might include limiting access to U.S. markets by foreign-owned carriers, enhanced-service providers, and equipment suppliers from countries that close or restrict their markets to U.S. equipment and service suppliers.

While the FCC pursues its inquiry, there is activity in the Congress toward settling the question of authority by legislation. The House Committee on Energy and Commerce, in approving H.R. 3, accepted a subcommittee amendment to the Telecommunications Trade Act (Title II). The "Rinaldo amendment" would clarify that the FCC has the authority to consider the impact of its decisions on telecommunications trade. The amendment (1) declares that the Commission is obligated under the public interest requirements of the 1934 Communications Act to consider the effects of international trade problems on the ability of the U.S. telecommunications industry to compete abroad and to provide quality equipment and services at home; (2) requires the Commission to report the

findings of its trade inquiry proceeding to Congress by November 1, 1987; and (3) directs the Commerce Department, in cooperation with the FCC, to study the "competitiveness" of the domestic telecommunications industry and the effects of foreign trade practices. The results would be available for use by the President in conducting negotiations or initiating sanctions under other parts of H.R. 3. The Senate's Omnibus Trade Act (S. 490), as reported by the Finance Committee, does not mention an FCC role in telecommunications trade.

SELECTED U.S. DOMESTIC POLICY AREAS THAT AFFECT TELECOMMUNICATIONS AND INFORMATION-SYSTEMS STANDARDS POLICY

What Is The Relation of Antitrust Policy to Standards Policy?

The National Cooperative Research Act of 1984 (P. L. 98-462), modified the U.S. antitrust laws to allow more joint industrial research by cooperating companies. The short history of the Act to date suggests that its impact in encouraging joint efforts in the (inherently) joint activity of standards implementation may be substantial. The Corporation for Open Systems, discussed under OPEN SYSTEMS INTERCONNECTION, was one of the first joint research ventures formed under the Act. The COS chose to file notification of its formation with the Attorney General and the Federal Trade Commission. This has the effect of limiting any damages awarded under the antitrust laws to actual damages plus costs and interest, rather than treble damages. Thus the Corporation enjoys partial sheltering from the antitrust laws. Whatever economic benefits may issue from the COS, the Corporation is designed primarily to coordinate the standardization interests of equipment manufacturers and

users, not to pursue the interests of the United States in a heterogeneous world.

Recognizing their importance to trade and U.S. competitiveness, and also their relation to one another, the Reagan Administration promised in late 1986 to treat antitrust policy and intellectual-property policy as part of its competitiveness package of legislative proposals to the 100th Congress. The Administration's competitiveness package, "The Trade, Employment, and Productivity Act of 1987," was introduced in Congress February 19, 1987 (H.R. 1155/S. 539). The bills, House and Senate, have nearly 30 "short titles," including several for antitrust and intellectual-property subjects. These are listed in tables 1 and 2 below.

TABLE 1. Antitrust Titles of H.R. 1155/S. 539

Antitrust Amendments Act of 1987
Antitrust Equal Enforcement Act of 1987
Antitrust Remedies Improvements Act of 1987
Foreign Trade Antitrust Improvements Act of 1987
Interlocking Directorate Act of 1987
Merger Modernization Act of 1987

TABLE 2. Intellectual-Property Titles of H.R. 1155/S. 539

Omnibus Intellectual Property Rights Improvement Act of 1987
Educational, Scientific, and Cultural Materials Importation Act of 1987
Regulation of Commerce in Digital Audio Recording Devices Act of 1987

What Is The Relation of Intellectual-Property Policy to Standards Policy?

What is the relation between U.S. intellectual-property (copyright, and patent) policies and the international trend toward standards for telecommuni-

cations and information-systems services, equipment, and software? Will U.S. intellectual-property policies affect, or be affected by, the trend toward standards? What about international agreements and enforcement instruments? Will current U.S. efforts to reach international agreements on intellectual property, and to strengthen the enforcement of such agreements, come into conflict with other U.S. efforts to establish and promote widely accepted international standards as a basis for freer international trade?

In 1980, P.L. 96-517 amended the Copyright Act of 1976 (17 USC 101 et. seq.) to provide that explicit computer programming text expressed in a computer language or code is a work of authorship protected by copyright, in both machine-readable and human-readable form. In a number of recent court cases, software and hardware developer-vendors are trying to broaden their claims of copyright protection.

In one key case, the court ruled that a "microcode" computer language, embedded in the hardware of a specific microcomputer processor chip, apart from any work of authorship expressed in the microcode language, is covered by copyright. The case was Intel Corp. vs. NEC Electronics Inc. U.S. District Judge William A. Ingram ruled in October 1986, in San Jose, California, that software in any form, including software embedded in a microchip that interprets commands, is a form of expression protected by copyright. This ruling was made apart from the issue of whether NEC actually did infringe Intel's copyright on the microcode of the 8086 and 8088 microprocessor chips used widely in personal computers designed for compatibility with the IBM PC informal industry "standard." (Datamation, November 1, 1986:41.)

In other cases, involving computer application programs, the software developer-vendors have claimed that the organization and structure of the

program's design and the appearance and sequence of the software's screen displays during use are protected by copyright. These cases include:

> Broderbund Software Inc., et. al. vs. Unison World Inc. U.S. District Judge William H. Orrick (San Francisco) decided that Unison's Printmaster software product copies the input formats, menu screens, and sequencing of screens in Broderbund's and Pixellite's Print Shop. This decision marked the first time a Federal court had ruled that developers of software other than game software can copyright the "look and feel" of a program's audiovisual displays. (Infoworld, October 20, 1986:1.)
>
> Whelan Associates Inc. vs. Jaslow Dental Laboratory Inc. The U.S. Supreme Court (January 1987) declined to hear Jaslow's appeal of the Third U.S. Circuit Court holding that the structure and organization of software are protected by copyright.

Within days of the Supreme Court's decision in Whelan vs. Jaslow, Lotus Development Corp. said it was considering seeking a Federal court preliminary injunction against two vendors of Lotus 1-2-3 "work-alike" programs (VP-Planner and The Twin) to stop them from selling their products. Lotus had already filed copyright-infringement damages lawsuits against the makers: Paperback Software of Berkeley, California and Mosaic Software of Cambridge, Massachusetts. News reports noted that users of 1-2-3 work-alike programs, and even some 1-2-3 users were unhappy with Lotus' legal action. One said, "I'm nervous about the whole development of a [do-not-copy-the] "look and feel" doctrine [because that doctrine] might stifle incremental improvements in product types." (Infoworld--1987, January 19:1, 26:1, February 2:61.)

A case pertaining to communications software is:

> Digital Communications Associates vs. Softklone Distributing Corp. Atlanta Federal Judge William C. O'Kelley upheld the copyright of Digital Communications' subsidiary, Microstuf Inc., on "the placement, arrangement and design" of words on a particular computer screen display. (The Wall Street Journal, April 2, 1987:32.)

Microstuf markets a personal-computer communications-software product called Crosstalk. Crosstalk is one of the most successful personal-computer telecommunications products, outselling other products in its class in both the

corporate and Federal Government markets. It is described in the personal-computer trade press as setting an informal standard for such products. Softklone sells a popular lower-priced product called Mirror, which imitates the functions of Crosstalk and adds other functions.

In this Alert's earlier description of the standardization process, views were stated and contrasted on whether standards could retard, or (alternatively) form a foundation for, innovation and progress. In the evolution of the standards process, substantial anxieties have been progressively overcome concerning the potential of standards to block progress. In the computer-user quote on this page above, the opinion expressed suggests that if copyright policy should prevent the evolution of an informal standard for a certain category of computer application software product, innovation could be stifled. Put another way, the quoted computer-user expressed an implicit belief that the informal standard in question was actually supportive of innovation.

The purposes of copyright policy and of standards policy both certainly include social and economic progress: copyright, by securing rights to material rewards for creativity; and standards, by developing social agreements to facilitate expansion of the markets for creativity's fruits. But standards have another function, too: to establish that past creativity has provided society with a solution which, if adopted broadly and consistently, can move creative efforts to a new level. The conflict now seen between copyright policy and standards policy may be arising at this time because the concrete results of those policies--copyrighted products and standardized products--have evolved in parallel with our society's increasing complexity. Now society develops needs for standardized systems but increasingly sees private claims of copyright on products which are components of such systems. As systems become more far-reaching and interconnected in our commercial life, as evolving

integrated-system standards require inclusion of prior product standards, the property right society grants and the standardization society seeks may come to a confrontation in the same system. If this is so, the separate political problems of managing intellectual-property policy and of managing standards policy may be converging in this long-term problem: managing an emerging conflict between these two policy areas as they relate to computer and information-system applications.

How Much Should the Government Support The Voluntary Standardization Process?

The United States has been a moderate supporter generally, and an ambivalent supporter financially, of voluntary computer and communications standards development.

In 1986, the Reagan Administration sought to reduce the budget of the National Bureau of Standards' Institute for Computer Sciences and Technology (ICST) by 50 percent for FY 1987. After considerable debate, a compromise was reached between the Administration and the Congress in which it was agreed that the ICST budget would be cut by 25 percent for FY 1987 and that no further cuts would be proposed by either the Department of Commerce or the OMB through FY 1989. (Congressional Record, October 10, 1986, H9855--daily edition.)

When this compromise expires, or breaks down, renewed controversy over funding levels can be expected to occur, and the congressional policy options for funding are the familiar ones of budget increases, budget reductions, or maintaining appropriations at current levels. Federal policy toward voluntary standardization is summarized in the Office of Management and Budget (OMB) Circular A-119, "Federal Participation in the Development and Use of Voluntary Standards," revised November 1, 1982.

What Is The Government Doing
To Standardize Its Own Information Systems?

If the compromise holds, and controversy over ICST funding subsides for a time, the Congress may wish to consider focusing attention on standardization activities within the Federal Government, in implementation of the Brooks-Act amendments made in the Paperwork Reduction Reauthorization Act of 1986 (Title VIII of H.J. Res 738; H. Rept. 99-105, p. 349-360 and 771-778). Among those amendments are:

(1) a greatly broadened definition of "automatic data processing equipment" (ADPE) to include telecommunications and other technical resources, and

(2) a requirement that all future Administrators of the OMB's Office of Information and Regulatory Affairs (OIRA) be subject to appointment by the President and confirmation by the Senate.

The "other technical resources" to which Federal Information Processing Standards now apply include: "any equipment or interconnected system or subsystems of equipment that are used in the automatic acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information, including communications." The conference report states further that "the intent of including these elements within the definition of automatic data processing equipment is to encourage Federal agencies to plan for and manage their information systems as [whole] entities, rather than separately managing elements of such systems."

The Office of Management and Budget (OMB) Circular A-130 (December 12, 1985) summarizes the Federal Government's policies toward management of Federal information resources. The Circular cites and quotes a report of the House Committee on Government Operations (H. Rept. 96-835, p. 3):

> The [Paperwork Reduction Act] legislation is the result of a growing concern that the way the Government collects, uses, and disseminates information must be improved. Inefficiencies in current Federal

> information practices drastically reduce the effectiveness of the Government while, at the same time, drowning our citizens in a sea of forms, questionnaires, and reports. (OMB Circular A-130, IV-4.)

The stated principles or purposes of the Act include these: to minimize the Federal paperwork burden for [the public], to minimize the cost to the Government, and to maximize the usefulness of information collected by the Government (A-130, IV-5). The Act requires that the OMB publish a five-year plan for Government-wide automatic data processing and telecommunications, review and coordinate agency proposals for information technology, and promote use of the technology to improve government operations (A-130, IV-12).

The OMB Circular states that the "prevailing agency practice of developing customized computer software is a source of inefficiency. . . managers are generally to prefer acquiring generic, off-the-shelf software available from the private sector instead of developing their own" (IV-13, -14). Agencies often acquire technology that is incapable of communicating with other systems with which the agencies need to communicate. Compatibility among information systems has consequently emerged as a significant . . . problem. Agencies must acquire or develop information systems in a manner that enhances necessary compatibility" (A-130, IV-14).

Circular A-130 further states that the National Bureau of Standards develops and issues Federal Information Processing Standards (FIPS) while the National Communications System develops, and the General Services Administration issues, Federal Telecommunications Standards. Some of these standards are mandatory and others voluntary but, in general, the OMB strongly recommends use of these standards Government-wide.

> Such standards can contribute to overall government economy and efficiency by increasing compatibility in computer and telecommunications networks, improving the transportability of software, and enabling computer systems to be developed using components of different manufacturers. These advantages can result in reduced procurement costs for equipment and services, improved competition, and better utilization of staff training and skills. While government-wide standards can result in management

efficiencies, agencies should be mindful that standards can also have the untoward effects of regulations, as noted in OMB Circular No. A-119 [Federal Participation in the Development And Use of Voluntary Standards]. Agencies should continuously assess relative costs and benefits of standards and their effects upon the agency's accomplishment of its mission. Note also that national security directives prescribe standards for computer security. [A-130, IV-15]

SOURCES OF ADDITIONAL INFORMATION

SELECTED CRS ISSUE BRIEFS AND REPORTS

Trade negotiations: the Uruguay round--CRS Issue Brief 86147, regularly updated.

Trade, technology, and competitiveness--CRS Issue Brief 87053, regularly updated.

Trade--CRS Issue Brief 87003, regularly updated.

Canada-U.S. freer trade negotiations--CRS Issue Brief 85215, regularly updated.

Telephone industry: residential access charges and lifeline telephone service --CRS Issue Brief 85152, regularly updated.

Trade legislation in the 99th Congress: alternative approaches to trade reform --CRS Issue Brief 86098, updated Nov. 6, 1986 (archived).

Japan-U.S. trade relations--CRS Issue Brief 81011, updated Nov. 4, 1986, (archived).

Telecommunications trade: market access legislation--CRS Issue Brief 85206, updated July 7, 1986 (archived).

Trade legislation in the 100th Congress: a comparison of selected trade bills --CRS Report 87-163 E, Mar. 1, 1987. 16 p.

The trade and economic reform act of 1987: a brief description of significant provisions, H.R. 3--CRS Report 87-136 E, Feb. 19, 1987. 6 p.

Trade negotiations: a review of upcoming talks--CRS Report 87-58 E, Jan. 21, 1987. 6 p.

U.S. intellectual property rights and trade--CRS Report 86-838E, Aug. 22, 1986. 10 p.

Telecommunications equipment trade: a statistical overview--CRS Report 86-114E, Apr. 4, 1986.

Background information related to the proposed spin-off of selected programs of the National Bureau of Standards [chapter III, "Institute for Computer Sciences and Technology" by Glenn McLoughlin]; A report to the House Committee on Science And Technology by the Library of Congress,

Congressional Research Service, Science Policy Research Division. Feb. 28, 1986. 149 p.

The National Bureau of Standards: a review of its organization and operations, 1971-1980; a study prepared for the Subcommittee on Science, Research and Technology of the Committee on Science And Technology, House of Representatives by the Library of Congress, Congressional Research Service, Science Policy Research Division. (97th Congress, 1st session) 1981. 266 p.

Technology and trade; some indicators of the state of U.S. industrial innovation; a report to the House Committee on Ways And Means by the U.S. Library of Congress, Congressional Research Service, Science Policy Research Division. (96th Congress, 2nd session) 1980. 36 p.

NATO standardization: political, economic and military issues for Congress; a report to the Committee on International Relations of the House of Representatives, by the Library of Congress, Congressional Research Service, Foreign Affairs and National Defense Division, 1977. 58 p.

Voluntary industrial standards in the United States--an overview of their evolution and significance for the Congress; a report to the Subcommittee on Science, Research and Development of the House Committee on Science and Astronautics by the Library of Congress, Congressional Research Service [Coord., Warren H. Donnelly], 1974. (93rd Congress, 2nd session). 122 p.

STATUTES AND OMB CIRCULARS

The Paperwork Reduction Authorization Act of 1986 (H.J. Res. 738, Title VIII).

The National Cooperative Research Act of 1984 (P. L. 98-462).

The Paperwork Reduction Act of 1980 (P.L. 96-511; 94 Stat. 2825).

The Brooks Act (1965; P. L. 89-306, 79 Stat. 1127).

The Federal Property and Administrative Services Act of 1949 (40 USC 759; 63 Stat. 377).

Management of Federal Information Resources [Circular A-130]. U.S. Office of Management and Budget. Dec. 12, 1985. 12 p., 4 appendices.

Federal Participation in the Development and Use of Voluntary Standards [Circular A-119--Revised]. U.S. Office of Management and Budget. Federal Register, Nov. 1, 1982: 49496-99.

PUBLICATIONS

An overview of the forums for standards and regulations for digital networks (by A. M. Rutkowski). Telecommunications, Oct., 1986, p. 84-96.

Standards in process: foundations and profiles of ISDN and OSI studies (NTIA Report 84-170). U.S. Dept. of Commerce, National Telecommunications and Information Administration. Dec., 1984. 246 p.

An evaluation update of America's voluntary standards system (conference). American National Standards Institute (ANSI). 1976.

The voluntary standards system of the United States of America (report). American Society for Testing and Materials (ASTM). 1975.

The shape, scope, and consequences of the age of information. Shultz, George P. [Address by The Honorable . . . Secretary of State before the Stanford Alumni Association's First International Conference, Paris, France.] Mar. 21, 1986.

ORGANIZATIONS

American National Standards Institute (ANSI), Information Systems Department, 1430 Broadway, New York, N.Y. 10018; (212) 642-4928.

Corporation for Open Systems (COS), 1750 Old Meadow Road, Suite 400, McLean, Virginia 22102-4306; (703) 883-2700.

Electronic Industries Association (EIA), 2001 Eye Street, N. W., Washington, D.C. 20006; Engineering Standards Sales (202) 457-4966.

European Computer Manufacturers Association (ECMA), 114, rue de Rhone, CH-1204 Geneva, Switzerland; 41 22 35-36-34, Telex 222 88.

Federal Telecommunications Standards Committee (FTSC), General Services Administration, Specification Distribution Branch, Building 197 (Washington Navy Yard), Washington, D.C. 20407.

Institute of Electrical and Electronics Engineers (IEEE), IEEE Computer Society, 1730 Massachusetts Ave., N. W., Washington, D.C. 20036; (202) 371-0101/785-0017.

International Organization for Standardization (ISO), Central Secretariat, 1, rue de Varembe, CH-1211 Geneva, Switzerland; 41 22 34-12-40. Copies of the ISO standards may be ordered from ANSI.

International Telegraph and Telephone Consultative Committee (CCITT), General Secretariat, International Telecommunications Union, Place de Nations, 1211 Geneva 20, Switzerland. Copies of the CCITT standards may be ordered from the NTIS at the address below.

MAP/TOP Steering Committee, Chairman: Charles J. Gardner, Corporate Coordinator of Systems Standards, Eastman Kodak Co., 343 State St., Rochester, N.Y. 14650; (716) 724-2265/724-4000.

National Bureau of Standards (U.S. Dept. of Commerce), Gaithersburg, Maryland 20899; (301) 975-2000.

Institute for Computer Science and Technology (NBS/ICST); (301) 975-2822. In addition to its roles in cooperation with U.S. private standards organizations and international standards organizations, NBS/ICST coordinates development of Federal Information Processing Standards (FIPS), which are internal U.S. Government standards. Copies of FIPS may be ordered from NTIS.

GATT Standards Code and Information Office (NBS-GATT); (301) 975-4029.

National Technical Information Service (NTIS--U.S. Dept. of Commerce), 5285 Port Royal Road, Springfield, Virginia 22161; (703) 487-4650. NTIS has no role in developing standards but disseminates copies of Federal Information Processing standards (FIPS) and International Telegraph and Telephone Consultative Committee (CCITT) standards.